NOAA Technical Report NMFS CIRC-392

Fishery Publications, Calendar Year 1974: Lists and Indexes

LEE C. THORSON and MARY ELLEN ENGETT

SEATTLE, WA
June 1975

noaa NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION / National Marine Fisheries Service

NOAA TECHNICAL REPORTS

National Marine Fisheries Service, Circulars

The major responsibilities of the National Marine Fisheries Service (NMFS) are to monitor and assess the abundance and geographic distribution of fishery resources, to understand and predict fluctuations in the quantity and distribution of these resources, and to establish levels for optimum use of the resources. NMFS is also charged with the development and implementation of policies for managing national fishing grounds, development and enforcement of domestic fisheries regulations, surveillance of foreign fishing off United States coastal waters, and the development and enforcement of international fishery agreements and policies. NMFS also assists the fishing industry through marketing service and economic analysis programs, and mortgage insurance and vessel construction subsidies. It collects, analyzes, and publishes statistics on various phases of the industry.

The NOAA Technical Report NMFS CIRC series continues a series that has been in existence since 1941. The Circulars are technical publications of general interest intended to aid conservation and management. Publications that review in considerable detail and at a high technical level certain broad areas of research appear in this series. Technical papers originating in economics studies and from management investigations appear in the Circular series.

NOAA Technical Reports NMFS CIRC are available free in limited numbers to governmental agencies, both Federal and State. They are also available in exchange for other scientific and technical publications in the marine sciences. Individual copies may be obtained (unless otherwise noted) from D83, Technical Information Division, Environmental Science Information Center, NOAA, Washington, D.C. 20235. Recent Circulars are:

315. Synopsis of biological data on the chum salmon, *Oncorhynchus keta* (Walbaum) 1792. By Richard G. Bakkala. March 1970, iii + 89 p., 15 figs., 51 tables.

319. Bureau of Commercial Fisheries Great Lakes Fishery Laboratory, Ann Arbor, Michigan. By Bureau of Commercial Fisheries. March 1970, 8 p., 7 figs.

330. EASTROPAC Atlas. Vols. 1-7. Catalog No. I 49.4:330 (vol.) 11 vols. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

331. Guidelines for the processing of hot smoked chub. By H. L. Seagran, J. T. Graikoski, and J. A. Emerson. January 1970, iv + 23 p., 8 figs., 2 tables.

332. Pacific hake. (12 articles by 20 authors.) March 1970, iii + 152 p., 72 figs., 47 tables.

333. Recommended practices for vessel sanitation and fish handling. By Edgar W. Bowman and Alfred Larsen. March 1970, iv + 27 p., 6 figs.

335. Progress report of the Bureau of Commercial Fisheries Center for Estuarine and Menhaden Research, Pesticide Field Station, Gulf Breeze, Fla., fiscal year 1969. By the Laboratory staff. August 1970, iii + 33 p., 29 figs., 12 tables.

336. The northern fur seal. By Ralph C. Baker, Ford Wilke, and C. Howard Baltzo. April 1970, iii + 19 p., 13 figs.

337. Program of Division of Economic Research, Bureau of Commercial Fisheries, fiscal year 1969. By Division of Economic Research. April 1970, iii + 29 p., 12 figs., 7 tables.

338. Bureau of Commercial Fisheries Biological Laboratory, Auke Bay, Alaska. By Bureau of Commercial Fisheries. June 1970, 8 p., 6 figs.

339. Salmon research at Ice Harbor Dam. By Wesley J. Ebel. April 1970, 6 p., 1 figs.

340. Bureau of Commercial Fisheries Technological Laboratory, Gloucester, Massachusetts. By Bureau of Commercial Fisheries. June 1970, 8 p., 8 figs.

341. Report of the Bureau of Commercial Fisheries Biological Laboratory, Beaufort, N.C., for the fiscal year ending June 30, 1968. By the Laboratory staff. August 1970, iii + 24 p., 11 figs., 16 tables.

342. Report of the Bureau of Commercial Fisheries Biological Laboratory, St. Petersburg Beach, Florida, fiscal year 1969. By the Laboratory staff. August 1970, iii + 22 p., 20 figs., 8 tables.

343. Report of the Bureau of Commercial Fisheries Biological Laboratory, Galveston, Texas, fiscal year 1969. By the Laboratory staff. August 1970, iii + 39 p., 28 figs., 9 tables.

344. Bureau of Commercial Fisheries Tropical Atlantic Biological Laboratory progress in research 1965-69, Miami, Florida. By Ann Weeks. October 1970, iv + 65 p., 53 figs.,

346. Sportsman's guide to handling, smoking, and preserving Great Lakes coho salmon. By Shearon Dudley, J. T. Graikoski, H. L. Seagran, and Paul M. Earl. September 1970, iii + 28 p., 15 figs.

347. Synopsis of biological data on Pacific ocean perch, *Sebastodes alutus*. By Richard L. Major and Herbert H. Shippen. December 1970, iv + 38 p., 31 figs., 11 tables.

349. Use of abstracts and summaries as communication devices in technical articles. By F. Bruce Sanford. February 1971, iii + 11 p., 1 fig.

350. Research in fiscal year 1969 at the Bureau of Commercial Fisheries Biological Laboratory, Beaufort, N.C. By the Laboratory staff. November 1970, ii + 49 p., 21 figs., 17 tables.

351. Bureau of Commercial Fisheries Exploratory Fishing and Gear Research Base, Pascagoula, Mississippi, July 1, 1967 to June 30, 1969. By Harvey R. Bullis, Jr. and John R. Thompson. November 1970, iv + 29 p., 29 figs., 1 table.

352. Upstream passage of anadromous fish through navigation locks and use of the stream for spawning and nursery habitat, Cape Fear River, N.C., 1962-66. By Paul R. Nichols and Darrell E. Louder. October 1970, iv + 12 p., 9 figs., 4 tables.

356. Floating laboratory for study of aquatic organisms and their environment. By George R. Snyder, Theodore H. Blahm, and Robert J. McConnell. May 1971, iii + 16 p., 11 figs.,

361. Regional and other related aspects of shellfish consumption — some preliminary findings from the 1969 Consumer Panel Survey. By Morton M. Miller and Darrel A. Nash. June 1971, iv + 18 p., 19 figs., 3 tables, 10 apps.

362. Research vessels of the National Marine Fisheries Service. By Robert S. Wolf. August 1971, iii + 46 p., 25 figs., 3 tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

364. History and development of surf clam harvesting gear. By Phillip S. Parker. October 1971, iv + 15 p., 16 figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

365. Processing EASTROPAC STD data and the construction of vertical temperature and salinity sections by computer. By Forrest R. Miller and Kenneth A. Bliss. February 1972, iv + 17 p., 8 figs., 3 appendix figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

366. Key to field identification of andromous juvenile salmonids in the Pacific Northwest. By Robert J. McConnell and George R. Snyder. January 1972, iv + 6 p., 1 figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

367. Engineering economic model for fish protein concentration processes. By K. K. Almenas, L. C. Durilla, R. C. Ernst, J. W. Gentry, M. B. Hale, and J. M. Marchello. October 1972, iii + 175 p., 6 figs., 6 tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

368. Cooperative Gulf of Mexico estuarine inventory and study, Florida: Phase I, area description. By J. Kneeland McNulty, William N. Lindall, Jr., and James E. Sykes. November 1972, vii + 126 p., 46 figs., 62 tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

369. Field guide to the anglefishes (Pomacanthidae) in the western Atlantic. By Henry A. Feddern. November 1972, iii + 10 p., 17 figs., For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Continued on inside back cover

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Fishery Publications, Calendar Year 1974: Lists and Indexes

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UNITED STATES
DEPARTMENT OF COMMERCE
Rogers C. B. Morton, Secretary

NATIONAL OCEANIC AND
ATMOSPHERIC ADMINISTRATION
Robert M. White, Administrator

National Marine
Fisheries Service
Robert W. Schoning, Director

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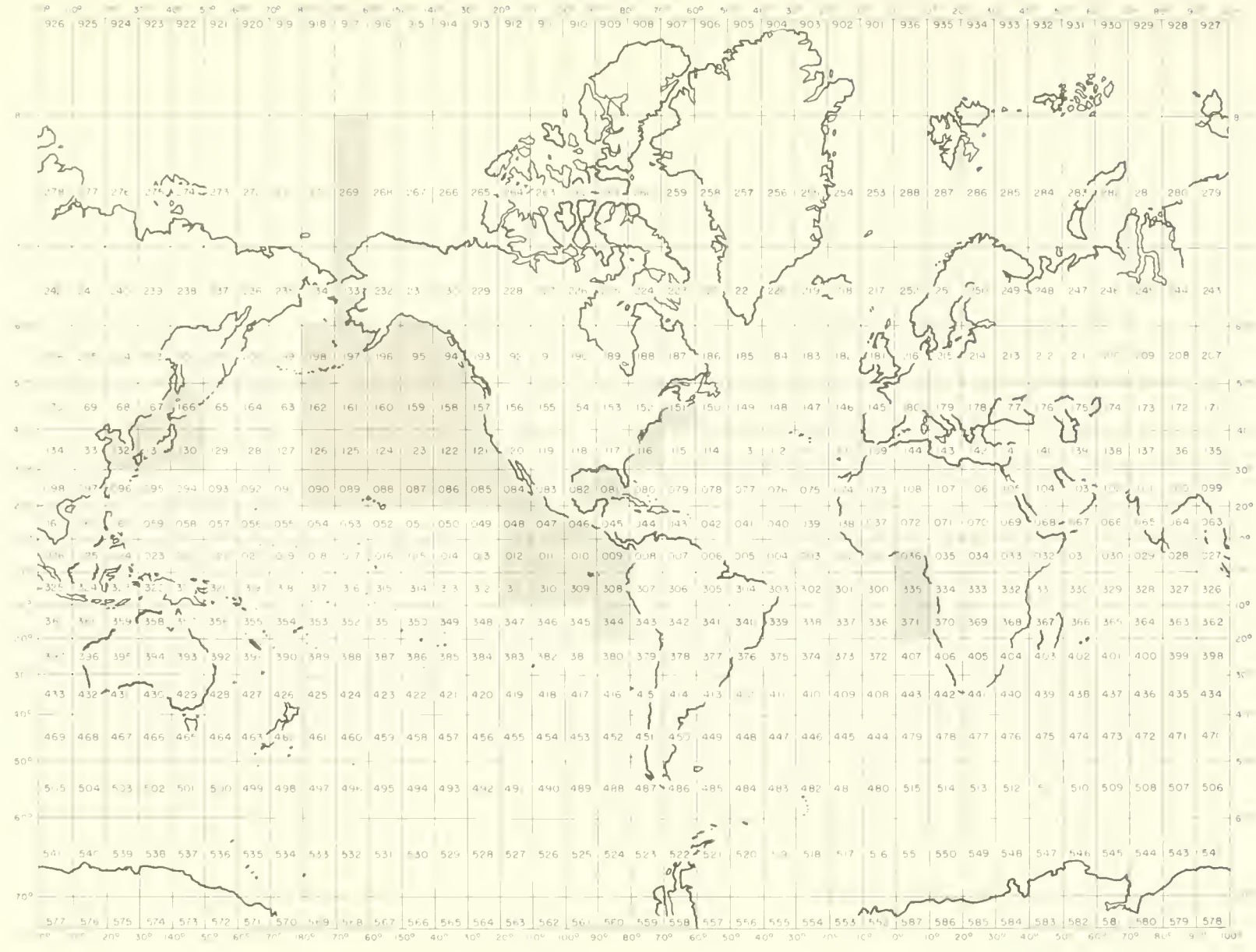

Figure 1.—Marsden square grid showing geographic areas (shaded) covered by fishery publications, calendar year 1974.

Fishery Publications, Calendar Year 1974: Lists and Indexes

LEE C. THORSON and MARY ELLEN ENGETT[1]

ABSTRACT

The following series of fishery publications of the National Marine Fisheries Service, National Oceanic and Atmospheric Administration, in calendar year 1974 are listed numerically (with abstracts) and indexed by author, subject, and geographic area: NOAA Technical Report NMFS CIRC (formerly Circular); Data Report; Fishery Facts; NOAA Technical Report NMFS SSRF; and NOAA Technical Memorandum NMFS.

INTRODUCTION

This document provides for calendar year 1974 numerical lists (with abstracts) and indexes by author, subject, and geographical area, of the following series of publications of the National Marine Fisheries Service, National Oceanic and Atmospheric Administration:

Circular
Data Report
Fishery Facts
Special Scientific Report—Fisheries
Technical Memorandum

The document is divided into four principal sections:

Numerical listing of series (with abstracts)
Author index
Subject index
Index by Marsden squares

The last section has been included to afford easy access to the publications for those persons interested in specific geographical areas. Figure 1 shows the Marsden squares treated in the several publications.

The series abbreviations used in the indexes are:

Circular	C
NOAA Technical Report NMFS CIRC	C
Data Report	D
Fishery Facts	FF
NOAA Technical Report NMFS SSRF	S
NOAA Technical Memorandum NMFS	TM

All series except the Data Report and NOAA Technical Memorandum NMFS are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Prices may be obtained from that office. The Data Report and NOAA Technical Memorandum NMFS are available from the National Technical Information Service.

LISTS

Circular

330. Vol. 8. EASTROPAC Atlas: Biological and Nutrient Chemistry Data from Principal Participating Ships and *Oceanographer* Third and Fourth Monitor Cruises, October 1967-January 1968. By Cuthbert M. Love (editor). March 1974, vii + 118 p., 184 figures. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402—Price $4.75 per volume.

ABSTRACT

This atlas contains charts depicting the distribution of physical, chemical, and biological oceanographic properties and associated meterological properties observed during EASTROPAC. EASTROPAC was an international cooperative investigation of the eastern tropical Pacific Ocean (20°N. to 20°S., and from the west coasts of the American continents to 119° W.) which was intended to provide data necessary for a more effective use of the marine resources of the area, especially tropical tunas, and also to increase knowledge of the ocean circulation, air-sea interaction, and ecology. The Bureau of Commercial Fisheries (now National Marine Fisheries Service) was the coordinating agency. The field work, from February 1967 through March 1968, was divided into seven 2-month cruise periods. During each cruise period one or more ships were operating in the study area.

On completion of the field work the data seemed too numerous for a classical data report. Instead, it was decided to produce an 11-volume atlas of the results, with 5 volumes containing physical oceanographic and meterological data from the principal participating ships, 5 volumes containing biological and nutrient chemistry data from the same ships, and 1 volume containing all data from Latin American cooperating ships and ships of opportunity. Extensive use was made of a computer and automatic plotter in preparation of the atlas charts. Methods used to collect and process the data upon which the atlas is based are described in detail by the contributors of the following categories of charts: temperature, salinity, and derived quantities; thickness of the upper mixed layer; dissolved oxygen; meteorology; nutrient chemistry; phytoplankton standing stocks and production; zooplankton and fish larvae; micronekton; birds, fish schools, and marine mammals.

NOAA TECHNICAL REPORT NMFS CIRC

387. Marine Flora and Fauna of the Northeastern United States. Crustacea: Stomatopoda. By Raymond B. Manning. February 1974, iii + 6 p., 10 figs.

ABSTRACT

This manual includes an introduction on the general biology, an illustrated key, an annotated systematic list, selected bibliography, and an index to the stomatopod Crustacea of the inner continental shelf of the northeastern United States. Four species are treated.

388. Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971. By William N. Shaw (editor). February 1974, iii + 133 p.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on

[1]Scientific Publications Staff, National Marine Fisheries Service, NOAA, 1107 N.E. 45th St., Room 450, Seattle, WA 98105.

Aquaculture at Tokyo, Japan, October 18-19, 1971—Remarks at First Meeting, UJNR Panel on Aquaculture, 18-19 October 1971. By Robert W. Hiatt. February 1974, p. 1-2.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—Present Status of Major Marine Cultivation and Propagation in Hokkaido and Some Problems of the Research Activities. By Yoshio Hasegawa and Yukimasa Kuwatani. February 1974, p. 3-6, 1 fig., 1 table.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—Mariculture of Seaweeds and Its Problems in Japan. By Shunzo Suto. February 1974, p. 7-16, 1 fig., 1 table.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—Some Technical Problems in Freshwater Fish Culture in Japan. By Hiroshi Kawatsu. February 1974, p. 17-22, 2 figs., 5 tables.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—The Present Status of Shellfish Culture in Japan. By Hisashi Kan-no and Tomoo Hayashi. February 1974, p. 23-25, 1 table.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—Fish Farming and the Constraints in Japan. By Masaru Fujiya. February 1974, p. 27-32, 4 figs., 1 table.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—Larval Culture of Penaeid Shrimp at the Galveston Biological Laboratory. By Cornelius R. Mock. February 1974, p. 33-40, 3 tables.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—Aquaculture in the National Sea Grant Program. By Robert D. Wildman. February 1974, p. 41-56, 1 app.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—Aquaculture of Molluscs Along the United States Atlantic and Gulf Goasts. By William N. Shaw. February 1974. p. 57-65.

(No Abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—Freshwater Fish Culture in the United States. By Harvey Willoughby. February 1974, p. 67-74, 1 table.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—Genetics of the American Oyster. *Crassostrea virginica* Gmelin. By A. Crosby Longwell. February 1974, p. 75-87, 9 figs., 2 tables.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—Recent Developments in Shellfish Culture on the U.S. Pacific Coast. By John B. Glude. February 1974, p. 89-95, 4 figs., 1 table.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—Seaweed Culture in Japan. By Robert Wildman. February 1974, p. 97-101.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—Freshwater Fish Culture in Japan. By Harvey Willoughby. February 1974, p. 103-105.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—Shellfish Culture in Japan. By William N. Shaw. February 1974, p. 107-110.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—Crustacean Culture. By Cornelius R. Mock. February 1974, p. 111-113, 1 table.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—Marine Fish Culture in Japan. By John B. Glude. February 1974, p. 115-121.

(No abstract)

(388.) Proceedings of the First U.S.-Japan Meeting on Aquaculture at Tokyo, Japan, October 18-19, 1971—

Some Impressions Regarding Genetics and the Fisheries of Japan. By A. Crosby Longwell. February 1974, p. 123-133.

(No abstract)

389. Marine Flora and Fauna of the Northeastern United States. Crustacea: Decapoda. By Austin B. Williams. April 1974, iii + 50 p., 111 figs.

ABSTRACT

The manual includes an introduction to general classification, an illustrated key, an annoted systematic list, a selected bibliography and a systematic index to the marine decapod crustaceans of the inshore and continental shelf waters of the northeastern United States.

390. Fishery Publications, Calendar Year 1973: Lists and Indexes. By Mary Ellen Engett and Lee C. Thorson. September 1974, iv + 14 p., 1 fig.

ABSTRACT

The following series of fishery publications of the National Marine Fisheries Service, National Oceanic and Atmospheric Administration, in calendar year 1973 are listed numerically (with abstracts) and indexed by author, subject, and geographic area: NOAA Technical Report NMFS CIRC (formerly Circular): Data Report; Fishery Facts; NOAA Technical Report NMFS SSRF; and NOAA Technical Memorandum NMFS.

DATA REPORT

(Hard copies and microfiche copies of Data Reports are for sale by the U.S. Department of Commerce, National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22151.)

82. Oceanic Conditions During the Joint Investigation of the Southeastern Tropical Atlantic (JISETA)—February, April, and September-December 1968. By Steven K. Cook, James F. Hebard, Merton C. Ingham, Ellsworth C. Smith, and Carlos Afonso Dias. March 1974, 358 p. on 6 microfiche.

ABSTRACT

Oceanic conditions in the upper 1,000 meters in the water column off tropical western Africa are portrayed. The portrayal is comprised of vertical sections of temperature, salinity, sigma-*t*, oxygen, and phosphate. A description of methods of sampling, analysis, data processing and quality control is presented.

83. Sample Catches of Penaeid Shrimp Taken by Trawling in the Northwestern Gulf of Mexico, 1961-65. By James M. Lyon and Kenneth N. Baxter. April 1974, 50 p. on 1 microfiche.

ABSTRACT

Data from a 5-yr shrimp trawling survey of the northwestern Gulf of Mexico are reported by station, time, and depth. Numbers of 12 species of penaeid shrimp taken during 113 cruises are recorded.

84. Hydrographic and Meteorological Observations From Tampa Bay and Adjacent Waters—1971, By Carl H. Saloman. March 1974, 554 p. on 9 microfiche.

ABSTRACT

Hydrographic data include water temperature, salinity, total phosphorus, total Kjeldahl nitrogen, pH, dissolved oxygen, turbidity, water transparency, chlorophyll *a*, *b*, and *c*, astacin and nonastacin carotenoids, and primary productivity based on chlorophyll *a* extraction. Hourly observations on air and water temperature, rainfall, wind velocity and direction, tidal height, barometric pressure, and daily recordings of solar radiation are also included. Methods of collecting and analyzing samples are described. Tables summarizing data collected from 30 permanent stations according to month and area, tables summarizing data for each individual station of the 30 permanent sites for 1966-71, and tables summarizing the mean, range, and number of observations of samples taken twice daily at the Laboratory dock are included.

85. Release and Recovery Data From Brown and White Shrimp Mark-Recapture Studies in the Northern Gulf of Mexico, May 1967-November 1969. By Stephen H. Clark, Dennis A. Emiliani, and Richard A. Neal. July 1974, 152 p. on 3 microfiche.

ABSTRACT

During seven mark-recapture studies conducted in the northern Gulf of Mexico during the period May 1967 to November 1969, personnel at the Galveston Laboratory released 75,947 brown shrimp (*Penaeus aztecus*) and 38,628 white shrimp (*P. setiferus*) marked with biological stains, fluorescent pigments, and plastic tags. Recovery of 6,192 brown shrimp and 917 white shrimp, provided data on growth, mortality, migration, and distribution by area and depth. Data for individual recoveries and other pertinent information are summarized in this report.

86. Observations on Growth of Southeastern Bering Sea King Crab, *Paralithodes camtschatica*, From a Tag-Recovery Study, 1955-65. By Douglas D. Weber. August 1974, 122 p. on 2 microfiche.

ABSTRACT

Growth data from a 10-yr tag-recovery study of southeastern Berging Sea king crab, *Paralithodes camtschatica*, were evaluated for sources of error and the usable growth information documented.

For simplified analysis of growth data the adult male crab growth increments may be combined since the increase in carapace length per molt averages 17.5 mm irrespective of size. For female crabs the growth per molt decreases with increase in carapace length.

The crabs' migratory pattern, molting stage at time of tagging, area of recapture, and selectivity of the fishery can influence interpretation of the growth data. The interaction of these parameters are presented, and it is suggested that these factors be considered in data application.

87. Hydrographic Observations in Tampa Bay and Adjacent Waters, May 1971 Through April 1973. By L. Alan Collins and John H. Finucane. August 1974, 146 p. on 3 microfiche.

ABSTRACT

Hydrographic data are given for water temperature, salinity, dissolved oxygen, and turbidity. Additional data include chlorophyll *a*, *b*, and *c*, astacin and nonastacin carotenoids, and primary productivity based on chlorophyll *a* extraction for 29 stations in Tampa Bay and the adjacent coastal waters from Clearwater south to Sarasota, Fla. Data on air temperature, water temperature, salinity and turbidity from daily observations at three sport fishing piers are provided. Tables summarize mean, range, and number of observations for each of the parameters by the months in which sampling occurred.

88. Trawl Catches and Oceanographic Data From NMFS Surveys of the Gulf of Alaska Pandalid Shrimp Resource, 1970-72. By Duane H. Petersen. August 1974, 573 p. on 9 microfiche.

ABSTRACT

Trawl catch and oceanographic data collected from five National

Marine Fisheries Service cruises to assess the relative abundance of the Pandalid shrimp resource in the Gulf of Alaska during 1970-72 are presented.

Station data are arranged in tabular form and provide information on location, depth, time and distance trawled, type of fishing gear used, and species catch by weight. Bottom temperatures and salinities for some studies are also included.

89. Compendium of Juvenile Menhaden Surveys in Coastal Streams of the Northern Gulf of Mexico. By William R. Turner, George N. Johnson, and Herbert R. Gordy. August 1974, 189 p. on 3 microfiche.

ABSTRACT

Catches of juvenile Gulf menhaden with two-boat surface trawls in coastal streams along the northen Gulf of Mexico are compiled for the period from 1964 through 1969. The catches are presented chronologically with accompanying hydrological data (including Secchi dise measurements, salinity determinations, and surface water temperatures) collected at each sampling station. Maps are provided defining the various areal designations, streams, and sampling stations.

90. Hydrographic Observations in Tampa Bay and Adjacent Waters—1972. By Carl H. Saloman and L. Alan Collins. August 1974, 176 p. on 3 microfiche.

ABSTRACT

Hydrographic data include water temperature; salinity; total phosphorus; total Kjeldahl nitrogen; pH; dissolved oxygen; tubidity; water transparency; chlorophyll *a*, *b*, and *c*, astacin and nonastacin carotenoids; and primary productivity based on chlorophyll *a* extraction. Methods of collecting and analyzing samples are described. Tables summarize data collected from 30 permanent stations by month and area. Additional tables summarize the mean, range, and number of observations of samples taken twice daily at the Laboratory dock.

91. Phytoplankton Pigment and Production Measurements in the California Current Region, 1969-72. By R. W. Owen, Jr. and C. K. Sanchez. November 1974, 185 p. on 3 microfiche.

ABSTRACT

Phytoplankton production, standing stocks, and some relevant environmental characteristics were for the first time systematically measured in the California Current system during the period from 1969 through 1972. This work describes the systems and methods of measurement, and presents the data obtained.

92. Zooplankton, Water Temperature, and Salinities in the Columbia River Estuary, December 1971 Through December 1972. By David A. Misitano. August 1974, 31 p. on 1 microfiche.

ABSTRACT

Sampling was conducted at seven stations in the Columbia River estuary throughout 1972 to provide baseline information on species diversity, relative abundance, and seasonal occurrence of zooplankton, as well as ambient water temperatures and salinities.

93. Catch Per Unit Effort and Mean Total Length of Brown Shrimp, *Penaeus aztecus* Ives, Taken by Trawl in the Galveston Bay System, Texas, 1963-67. By Lee Trent, Edward J. Pullen, Genevieve Adams, and Gilbert Zamora, Jr. September 1974, 42 p. on 1 microfiche.

ABSTRACT

This report presents catches per unit effort and mean lengths for brown shrimp, *Penaeus aztecus* Ives, taken with a trawl and trawl cod end cover from the Galveston Bay system, Texas during 1963-67 by personnel of the Estuarine Program, National Marine Fisheries Service, NOAA, Galveston, Texas. The number of stations at which samples were taken ranged from 58 in 1963 to 16 in 1967. Sampling frequency varied from weekly to monthly; in 1967 samples were not taken throughout the year. Stations were located within three habitats—peripheral, open water, and channel—within each bay area of the system except West Bay. Catch per unit effort was defined as the number of brown shrimp caught per 5-min tow in a 0.6 ×3.0 m otter trawl and the number caught per tow in the cod end cover.

94. Benthic Macroinvertebrates and Sediments From Upland Canals in Tampa Bay, Florida. By John R. Hall and William N. Lindall, Jr. September 1974, 221 p. on 4 microfiche.

ABSTRACT

Samples from 34 stations in upland canals of Tampa Bay, Fla., contained 139 species and 66,326 specimens of benthic macroinvertebrates. Collections were made from August 1970 through November 1971. Tables give monthly counts by species, individuals, and total individuals per square meter. A summary of the total number of species and individuals, and their monthly range and mean is presented. Mean grain size, standard deviation, skewness, kurtosis, and weight percentage of granule, sand, silt, and clay-sized sediment particles are also recorded.

95. Data of the Biology Phase, Florida Portion, Cooperative Gulf of Mexico Estuarine Inventory. By J. Kneeland McNulty, William N. Lindall, Jr., and Ernest A. Anthony. September 1974, 229 p. on 4 microfiche.

ABSTRACT

Data of the Florida portion of the Biology Phase of the Cooperative Gulf of Mexico Estuarine Inventory are recorded. They consist of the catches made by seine, trawl, and plankton net at Chokoloskee in the Ten Thousand Islands, Bokeelia in Charlotte Harbor, Maximo Point in Tampa Bay, Atsena Otie Key near Cedar Key, and at the mouth of the St. Marks River. Monthly samples were taken from April 1968 through March 1969. Water temperature and salinity at the times of sampling are recorded.

96. Groundfish and Crab Resources in the Gulf of Alaska—Based on International Pacific Halibut Commission Trawl Surveys, May 1961-March 1963. By Steven E. Hughes. October 1974, 87 p. on 2 microfiche.

ABSTRACT

Results of a trawl survey of groundfish and crab resources occurring between Cape Spencer and Unimak Island, Alaska, are presented. The survey was conducted by the International Pacific Halibut Commission during 1961-63; catch records from 1,272 stations were recently analyzed and prepared by the Northwest Fisheries Center. Information presented shows seasonal patterns of geographic and depth distribution, in addition to relative abundance of all major species occurring in the Gulf of Alaska. For each group (flatfish, roundfish, rockfish, elasmobranchs, and crab) and major species, a brief narrative of results is accompanied by figures showing percentage and catch rate information by area-season-depth categories. In addition, 40 charts show detailed seasonal information on eight major groundfish as well as king and Tanner crabs.

97. Hydrographic Observations From a Natural Marsh and a Marsh Altered by Dredging, Bulkheading, and Filling in West Bay, Texas. By Edward J. Pullen and Lee Trent. October 1974, 15 p. on 1 microfiche.

ABSTRACT

Hydrographic data were collected from a natural marsh and a marsh altered by dredging, bulkheading, and filling in West Bay, Texas. Water samples were taken at 2-wk intervals during the day and night at 10 stations from 25 March to 21 October 1969. This report contains the location, depth, date, and time the samples were taken and corresponding measurements of water temperature,

salinity, dissolved oxygen, dissolved organic nitrogen, nitrite, total phosphorus, inorganic phosphate-phosphorus, pH, carbon dioxide, total alkalinity, carbonate alkalinity, and turbidity.

FISHERY FACTS

7. A Trapping System for Harvesting Sablefish Anoplopoma fimbria. By Fred W. Hipkins. November 1974, 20 p., 17 figs.

ABSTRACT

An improved method of commercial fishing for sablefish, commonly known as black cod (not related to the family of codfishes), is now used by commercial fishermen from California to Alaska. Fish are captured and impounded in lightly constructed, baited traps. The traps are collapsible (they fold down) but are rigid when set out to fish. They can be completely covered with webbing or steel wire mesh. Fish impounded in the traps, which are attached to groundlines, are alive and in excellent condition when brought aboard the fishing vessels. The traditional setline method for fishing sablefish requires considerably more bait, larger fishing crews, and many more hours of work per day to catch a comparable amount of sablefish.

Datails of the trapping gear, setlines, and buoylines, plus the vessel equipment, fishing instructions, and locations of traditional fishing grounds are described.

8. Sanitation Recommendations for Fresh and Frozen Fish Plants. By J. Perry Lane. November 1974, 39 p., 14 figs.

ABSTRACT

The problem of sanitation in fish-processing plants is receiving increasing attention from Federal and State regulatory agencies, as well as private industry. This article covers recommended guidelines that can assist the processors of fresh and frozen fish in evaluating their existing sanitation practices or in establishing new ones.

9. Design and Materials Used in Construction of a 16-Foot Shrimp Trawl. By Elmer J. Gutherz, Anthony F. Serra, and Edward F. Klima. December 1974, 14 p., 12 figs., 1 table.

(No abstract)

10. How to Build Marine Artificial Reefs. By R. O. Parker, Jr., R. B. Stone, C. C. Buchanan, and F. W. Steimle, Jr. December 1974, 47 p., 21 figs., 1 table, 4 app. figs.

ABSTRACT

Artificial reefs provide or improve rough bottom habitat and offer fishery scientists and administrators an effective technique to conserve and develop coastal fishery resources. With careful planning and organized efforts, local reef committees can build reefs to improve fishing and contribute to the recreational and financial growth of coastal communites. Advice and procedures are presented for: 1) selecting construction materials, 2) determining a suitable reef site, 3) obtaining permits, 4) buoying the reef, and 5) preparing, transporting, and placing reef-building materials. Included in appendixes are instructions for preparing permits, addresses of Federal and State agencies involved in approving or funding reef construction, and addresses of manufacturers of materials and equipment.

NOAA TECHNICAL REPORT NMFS SSRF

674. Lake Erie Bottom Trawl Explorations, 1962-66. By Edgar W. Bowman. January 1974, iv + 21 p., 9 figs., 1 table, 7 app. tables.

ABSTRACT

The Bureau of Commercial Fisheries (now the National Marine Fisheries Service) Exploratory Fishing and Gear Research Base, at Ann Arbor, Mich., surveyed the abundance, availability to the otter (bottom) trawl, and depth distribution of various Lake Erie fish stocks between April 1962 and October 1966. The four exploratory cruises, conducted aboard the research vessel *Kaho*, clearly demonstrated the effectiveness of the bottom trawl in producing commercial quantities of yellow perch, *Perca flavescens*, and rainbow smelt, *Osmerus mordax*. Freshwater drum, *Aplodinotus grunniens*; carp, *Cyprinus carpio*; channel catfish, *Ictalurus punctatus*; and white bass, *Roccus chrysops*, were all produced in commercial quantities at least once during the study and collectively account for 17.1% of the total landings.

Between the first exploratory cruise in 1962 and the last in 1966 the abundance of yellow perch decreased significantly, and that of alewife, *Alosa pseudoharengus*, increased dramatically.

675. Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers. By Richard S. Shomura and Francis Williams (editors). July 1974, iv + 335 p.

(No abstract)

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—A Review of the World Commercial Fisheries for Billfishes. By Shoji Ueyanagi. July 1974, p. 1-11.

ABSTRACT

This report gives a general "overview" of the commercial fisheries for billfishes. The present world production of billfishes is approximately 100,000 tons per year, of which more than 90% is taken by the tuna longline fishery. Japan alone produces about 70% of the world's catch of billfishes and is the principal consumer nation of these fish.

Although billfishes account for only about 18% of the longline catches, they are presently of considerable importance, especially among the fishery products utilized in Japan. This report discusses the value and utilization of billfishes in Japan, and describes how billfishes have gained status as a quality fish, commanding prices comparable to the tunas. In addition, the expansion of the longline fishery is described, showing that by 1965 the fishery had covered the entire distributional range of the billfishes. Catch and effort data for billfishes indicate that 1) swordfish is the only species which has shown an increase in landings in recent years, 2) blue marlin landings have decreased in recent years in the South Pacific, Atlantic, and to a slightly lesser degree, also in the Indian Ocean, and 3) the catch of the striped marlin has fluctuated greatly from year to year.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—A Review of the World Sport Fishery for Billfishes (Istiophoridae and Xiphiidae). By Donald P. de Sylva. July 1974, p. 12-33.

ABSTRACT

Sport fishing is conducted for billfishes (Istiophoridae and Xiphiidae) in nearly all warm oceans, primarily in tropical and subtropical seas. In probable order of descending catch rate, the principal species caught by anglers are sailfish, white marlin, blue marlin, striped marlin, black marlin, swordfish, and longbill spearfish; the shorthill and Mediterranean spearfishes are rarely taken by anglers. Important sport fisheries are presently concentrated from Massachusetts to North Carolina and about Bermuda, southeastern Florida, the northern and northeastern Gulf of Mexico, the Bahamas, the larger islands of the Caribbean, Venezuela, the eastern tropical Pacific between southern California and Chile, Hawaii, New Zealand and eastern Australia, Kenya to Cape Town, South Africa, Ivory Coast to Senegal, West Africa, and off Portugal, Spain, and Italy.

In some regions maximum angling effort coincides with maximum availability of billfish, while in others, especially in the western North Atlantic, maximum angling pressure is correlated

with angling tournaments which in turn relate to summer vacations of tourists and the tendency of most anglers to fish only during the day and when the weather is favorable. Angling for billfish during the "off-season" may well produce good results in areas which usually are heavily fished only at certain periods. New billfishing regions probably can be developed, but this requires the assistance of local governments to provide or ensure adequate sportfishing vessels, docks, bait, and, especially, qualified captains and crews.

Because of the relative inefficiency of the gear used by anglers to catch billfish, it is unlikely that angling can deplete the billfish stocks, other factors such as natural environmental fluctuations, pollution, or commercial fishing being equal. There is evidence that commercial fishing in the eastern Pacific is affecting the sport catches of sailfish and striped marlin. Based on commercial catch data, the mean size of sailfish and striped marlin and their hooking rate have decreased. In the Caribbean the catch rate of blue marlin and white marlin by commercial fishermen has decreased; this phenomenon may be attributed to heavy commercial fishing pressure from longline fleets.

The economic value of the billfish sport fishery is extremely high to local communities which support angling activities. In spite of some aesthetic feelings which promote releasing of billfish which are not tagged, it would appear that catches by anglers could be retained for human consumption without seriously depleting the stocks, thus further contributing to local economy.

Sport fishing for billfishes poses special problems because of the complexity, expense, expertise required, and lack of basic information on the fisheries and the fishermen. Possible solutions to these are discussed.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—The Paleontology of Billfish—The State of the Art. By Harry L. Fierstine. July 1974, p. 34-44.

ABSTRACT

The major osteological features are described for living billfishes. All billfish remains are reviewed critically and some questionable forms are placed in Xiphioidei Incertae Sedis (uncertain status). The remaining xiphioids are placed into three families: Istiophoridae, Xiphiidae, and Xiphiorhynchidae. A new undescribed xiphiid from Mississippi shows that the billfish lineages must have diverged prior to the Eocene. Areas of research are suggested that will help place the paleontological studies on a more secure foundation.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Some Aspects of the Systematics and Distribution of Billfishes. By Izumi Nakamura. July 1974, p. 45-53.

ABSTRACT

Until recently the classification of billfishes (Xiphiidae and Istiophoridae) was confused. Recent workers have consolidated the nominal species and reduced the number of species considerably. A key, with figures, is presented which includes two families, four genera, and 11 species. *Makaira mazara* is considered distinct from *M. nigricans* because of consistent differences in the pattern of the lateral line system. *Tetrapterus platypterus* is tentatively separated from *T. albicans* although existing differences are minor and could be referable to the subspecific level. The worldwide distribution of billfishes is given; distributions are based primarily on data from the Japanese longline catch for 1964-69.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—The Validity and Status of the Roundscale Spearfish, *Tetrapturus georgei*. By C. Richard Robins. July 1974, p. 54-61.

ABSTRACT

A fourth Atlantic species of the istiophorid genus *Tetrapturus* was discovered in 1961 among commercial catches landed in Sicily, Portugal, and Spain. Subsequent efforts to obtain information have failed because the fishermen do not distinguish the species and it is apparently much less common than *T. belone* in Sicily and *T. albidus* in Spain and Portugal.

The species is described in detail. Important distinguishing features are: the form of the scales on the midside, the shape of the lobes of the spinous dorsal and anal fins, the position of the anus, and the pectoral-fin length.

The nomenclatural validity of *Tetrapturus georgei* Lowe is discussed and reasons are given for applying this name to the newly discovered species.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Evaluation of Identification Methods for Young Billfishes. By William J. Richards. July 1974, p. 62-72.

ABSTRACT

Most of the papers published from 1831 to date which deal with the identification of young billfishes (Families Xiphiidae and Istiophoridae) are reviewed. The present knowledge of the identification of adults is compared with the identification of young and problem areas are defined. Suggestions are made to resolve the present problems encountered with the identification of the young stages (eggs, larvae, and juveniles). These suggestions include the need for detailed osteological descriptions of the young, the need for an increased effort to collect specimens, and the need to artificially rear specimens in the laboratory.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—On an Additional Diagnostic Character for the Identification of Billfish Larvae with Some Notes on the Variations in Pigmentation. By Shoji Ueyanagi. July 1974, p. 73-78.

ABSTRACT

The larvae of five species of billfishes (Istiophoridae) occurring in the Indian and Pacific Oceans—sailfish, *Istiophorus platypterus*; shortbill spearfish, *Tetrapturus angustirostris*; striped marlin, *T. audax*; blue marlin, *Makaira mazara*; and black marlin, *M. indica*—have now been identified. The identification of these larvae has depended on such characters as the shape of the pectoral fin, pigmentation of the branchiostegal membrane, pigmentation of the lower jaw membrane, and head profile.

Some problems in identification remain, however, as for example in the differentiation between very small larvae (under 7 mm) of striped marlin and blue marlin. Recent studies have resulted in additional diagnostic characters which differentiate between these two species, namely the differences in the pterotic and preopercular spines.

The larvae of sailfish generally have pigment on the posterior half of the lower jaw, and this pigmentation is recognized to be species specific. There exist, however, some larvae of this species which lack this characteristic pigmentation, and the occurrence of these larvae seems to vary geographically from the more typical sailfish larvae.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Comparative Development of Atlantic and Mediterranean Billfishes (Istiophoridae). By Donald P. de Sylva and Shoji Ueyanagi. July 1974, p. 79. Abstract only.

ABSTRACT

Developmental stages from about 5 mm to the adult stage are described, illustrated, and compared for the following species: Atlantic sailfish, *Istiophorus platypterus*; white marlin, *Tetrapturus albidus*; Mediterranean spearfish, *Tetrapturus belone*; longbill spearfish, *Tetrapturus pfluegeri*; and Atlantic blue marlin, *Makaira nigricans*. Most descriptions are based on material from the western North Atlantic Ocean including the DANA collections from the Sargasso Sea. The status of two other billfish—*Tetrapturus georgei* from the eastern Atlantic and the so-called "hatchet marlin" of the western Atlantic—is discussed briefly in reference to the identity of an unidentifiable juvenile from the Mediterranean Sea.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Life History of the Atlantic Blue Marlin, *Makaira nigricans*, with Special Reference to Jamaican Waters. By Donald P. de Sylva. July 1974, p. 80. Abstract only.

ABSTRACT

Nomenclature and systematics of the Atlantic blue marlin are briefly reviewed. Its seasonal distribution in the Atlantic is analyzed from commercial and sport fish records. The spawning season in the North Atlantic, which occurs from late spring through late fall, is discussed. Larvae and juveniles are not common, but are easily identifiable. Spawning probably occurs far offshore, with the young developing in waters of the high seas. Feeding probably occurs in the deeper strata. Tunas, frigate mackerels, and cephalopods are the main food items. The growth rate has not been determined, but it is suspected that blue marlin exceed 15 yr. Females attain a much larger size than the males; this is attributed to differential mortality. The blue marlin probably undergoes reasonably extensive migrations, and may be considered to comprise populations at least in the North Atlantic and South Atlantic Oceans. The sport fishery, which is extensive and expensive, and valuable economically, is thoroughly discussed. The commercial fishery for the species in the Atlantic is incidental to the tuna fisheries, yet there are some indications that the blue marlin is in some danger of being depleted through commercial activities.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—On the Biology of Florida East Coast Atlantic Sailfish, (*Istiophorus platypterus*). By John W. Jolley, Jr. July 1974, p. 81-88.

ABSTRACT

The sailfish, *Istiophorus platypterus*, is one of the most important species in southeast Florida's marine sport fishery. Recently, the concern of Palm Beach anglers about apparent declines in numbers of sailfish caught annually prompted the Florida Department of Natural Resources Marine Research Laboratory to investigate the biological status of Florida's east coast sailfish populations.

Fresh specimens from local sport catches were examined monthly during May 1970 through September 1971. Monthly plankton and "night-light" collections of larval and juvenile stages were also obtained. Attempts are being made to estimate sailfish age using concentric rings in dorsal fin spines. If successful, growth rates will be determined for each sex and age of initial maturity described. Females were found to be consistently larger than males and more numerous during winter. A significant difference in length-weight relationship was also noted between sexes.

Fecundity estimates varied from 0.8 to 1.6 million "ripe" ova, indicating that previous estimates (2.5 to 4.7 million ova) were probably high. Larval istiophorids collected from April through October coincided with the prominence of "ripe" females in the sport catch. Microscopic examination of ovarian tissue and inspection of "ripe" ovaries suggest multiple spawning.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Some Biological Observations of Billfishes Taken in the Eastern Pacific Ocean, 1967-1970. By Maxwell B. Eldridge and Paul G. Wares. July 1974, p. 89-101.

ABSTRACT

From 1967 through 1970 sport-caught billfishes were sampled at Mazatlán, Sinaloa; and Buena Vista, Baja California, and at San Diego, California. Lengths, weights, morphometrics, meristics, and gonad data were gathered on a total of 2,056 striped marlin, 821 sailfish, 61 blue marlin, and 1 black marlin. This paper presents information on reproduction, average length and condition factor, food habits for 1970, and notes on parasites.

Developing gonads were found only in the Mexican fish. Our data on reproduction indicated that both striped marlin and sailfish spawn once per year with peak spawning activity probably in June and July. There is also the possibility that sailfish spawn in other months. First maturity in striped marlin and sailfish occurred in the 155-165 cm eye-fork length class. Fecundity estimates ranged from 2 to 5 million eggs for four sailfish and from 11 to 29 million eggs for three striped marlin. It appears that striped marlin move offshore from the Mexican coastline to spawn while sailfish remain closer to shore.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Scientific Billfish Investigation: Present and Future; Australia, New Zealand, Africa. By Charles O. Mather. July 1974, p. 102. Abstract only.

ABSTRACT

I. Scientists, anglers, skippers, and mates investigate and apply the scientific method.
The importance of knowledge, organization, and skills required of the scientist, angler, skipper, and mate in order to bring about a better understanding of the billfish and better methods of catching billfish is discussed.

II. The need for more observations and recording of data.
The following data should be given important consideration: temperature, depth, time, winds, currents, strike-catch ratio, bait, and the ship's log; these topics are reviewed.

III. Scientific research projects for consideration in the future.
Potential research projects in Australia, New Zealand, and Africa are presented. Some projects worthy of consideration include: (1) breeding of black marlin at the Great Barrier Reef, Australia; (2) transplanting of small black marlin to a natural salt water lake for study and observation of growth and development (Australia); (3) migration studies by tracking (Australia, New Zealand, Africa); (4) general blood cell surveys (New Zealand); (5) general chromosome surveys (New Zealand); and (6) sensory and motor responses of billfish in relation to sight, smell, and pain (Africa).

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Biology of Swordfish, *Xiphias Gladius* L., in the Northwest Atlantic Ocean. By James S. Beckett. July 1974, p. 103-106.

ABSTRACT

The present knowledge of the biology of swordfish in the northwest Atlantic Ocean is summarized. Distribution of swordfish is bounded by 13°C surface isotherms with smaller (under 160 cm) fish in water above 18°C. Males are smaller (under 200 cm) than females and are more frequent in warmer, southern areas. Large fish make feeding excursions to the bottom, to depths of 500 m or more and temperatures 5-10°C. Females attain sizes of 550 kg and males 120 kg, but average size was 54 kg in 1970 commercial landings. Growth is thought to be rapid with weights of 4, 15, 40, 70, and 110 kg attained at annual intervals. Spawning is confined to warmer (over 24°C) southern waters. Tagging data (13 recoveries) suggest fish spend the summer in one locality and return there in subsequent years. High recoveries (18.3%) have been made of fish tagged while swimming free.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Some Morphometrics of Billfishes From the Eastern Pacific Ocean. By Paul G. Wares and Gary T. Sakagawa. July 1974, p. 107-120.

ABSTRACT

Length-weight and morphometric data collected over 4 yr (1967-70) from sport fisheries at three eastern Pacific locations are presented for striped marlin (*Tetrapturus audax*), sailfish (*Istiophorus platypterus*), and blue marlin (*Makaira nigricans*). The data were gathered from San Diego, California (U.S.A.). Buena Vista, Baja California Sur (Mexico), and Mazatlán, Sinaloa (Mexico).

Regression of eye-fork length and covariance analysis were used to compare maximum body depth, depth at vent, pectoral fin length, dorsal fin height, maxillary length, snout to mandible and snout to posterior orbit lengths between sexes and areas for each species. Regression equations are given for converting fork length

and mandible fork length to eye fork length. Based on these conversions our Pacific Ocean data on sailfish are compared with data from the Atlantic Ocean.

Length-weight regressions using both eye-fork length and fork length are given for each species by sex.

(675.) Proceedings of the International Billfish Symposium, Kailua Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed papers—Analysis of Length and Weight Data on Three Species of Billfish From the Western Atlantic Ocean. By William H. Lenarz and Eugene L. Nakamura. July 1974, p. 121 125.

ABSTRACT

Estimates of parameters of relations among weight, girth, total length, fork length, body length, trunk length, and caudal spread were made for blue marlin, white marlin, and sailfish captured in the western Atlantic. Some sexual differences were found.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Length-Weight Relationships for Six Species of Billfishes in the Central Pacific Ocean. By Robert A. Skillman and Marian Y. Y. Yong. July 1974, p. 126-137.

ABSTRACT

Weight-length relationships for six species of billfishes in the central Pacific Ocean were developed by analyzing 20 yr of data. Log-linear and nonlinear statistical models were fitted to the data by regression analysis, and residuals from the models were tested. Blue marlin, *Makaira nigricans* Lacépède, (50-135 cm FL), male blue marlin ($\geq$ 135 cm FL) and sailfish, *Istiophorus platypterus* (Shaw and Nodder), apparently have coefficients of allometry less than 3.0. Black marlin, *M. indica* (Cuvier) and female blue marlin ($\geq$ 135 cm FL) apparently have coefficients equal to 3.0. Shortbill spearfish, *Tetrapturus angustirostris* Tanaka, striped marlin, *T. audax* (Philippi), and swordfish, *Xiphias gladius* Linnaeus, apparently have coefficients greater than 3.0.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Food and Feeding Habits of Swordfish, *Xiphias gladius* Linnaeus, in the Northwest Atlantic Ocean. By W. B. Scott and S. N. Tibbo. July 1974, p. 138-141.

ABSTRACT

Food and feeding habits of swordfish were studied by examining stomachs of 141 individuals captured from July to October 1971 between the Grand Bank and the southeast part of Georges Bank in the Northwest Atlantic Ocean. A wide variety of fish species made up about 80% of the diet; the remainder was squid. Species and size composition of food fishes depended on the feeding area. Large redfish (*Sebastes marinus*) were the most important food item in the Western Bank and Grand Bank areas, whereas silver hake (*Merluccius bilinearis*) made the greatest contribution in the Georges Bank area. Barracudinas, family Paralepididae, occured most frequently and constituted about 20% of the fish diet for all areas. Sabertoothed fishes, family Evermannellidae, also occurred in samples from all areas.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Maturation and Fecundity of Swordfish, *Xiphias gladius*, From Hawaiian Waters. By James H. Uchiyama and Richard S. Shomura. July 1974, p. 142-148.

ABSTRACT

Sixteen swordfish, *Xiphias gladius*, ovaries ranging in weight from 39 to 20,000g were examined. Fish size ranged from 47 to 246 kg. Based on the occurrence of ripe ovaries, spawning in Hawaiian waters was estimated to extend from April through July. The developmental stages of ova are described; the most advanced ova examined averaged 1.6 mm in diameter. The distribution of ova diameters within an ovary was found to be heterogeneous. Fecundity was estimated for eight swordfish. Some variability in fecundity was noted; a positive curvilinear relationship of increase in fecundity with increase in fish size was evident. Best estimates suggest that an 80 kg swordfish has 3.0 million ova (early ripe or ripe stages) and a 200 kg swordfish has 6.2 million ova.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Occurrence, Morphology, and Parasitism of Gastric Ulcers in Blue Marlin, *Makaira nigricans*, and Black Marlin, *Makaira indica*, from Hawaii. By Robert T. B. Iversen and Richard R. Kelley. July 1974, p. 149-153.

ABSTRACT

Gastric ulcers were found in 10 of 114 blue marlin, *Makaira nigricans*, and 2 of 3 black marlin, *M. indica*, examined from 1967 to 1969 at the Hawaiian International Billfish Tournament. Parasitic nematodes were found imbedded in the base of ulcers in one blue marlin and two black marlin. The gross and microscopic morphology of the ulcers is given and possible causes are discussed. The most likely cause is either mechanical injury or parasites, or the effect of both in the same stomach.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Mercury in Swordfish and Other Pelagic Species From the Western Atlantic Ocean. By James S. Beckett and H. C. Freeman. July 1974, p. 154 159.

ABSTRACT

Total mercury determinations have been carried out on at least one tissue from each of 210 swordfish, 40 specimens of 15 other pelagic species, and 235 individuals of 12 species taken from swordfish stomachs. Total mercury levels of swordfish white muscle tissue ranged from 0.05 to 4.90 parts per million (ppm) (mean 1.15 ppm) total mercury. Mercury levels were broadly related to fish size with the larger fish having higher levels but the relationship varied with time and area of capture. Males tended to have higher levels thao females. The mercury levels of different tissues (red muscle, liver, kidney, heart, brain, gill, vertebral disc, and stomach) are given. The differences in the levels in certain tissues from fish taken in different areas suggest greater physiological activity of mercury in fish from the southern area. The significance of mercury in swordfish prey species is discussed.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Mercury in Several Species of Billfishes Taken Off Hawaii and Southern California. By Richard S. Shomura and William L. Craig. July 1974, p. 160-163.

ABSTRACT

The results of analyses of the mercury content of 37 blue marlin, *Makaira nigricans*, 56 striped marlin, *Tetrapturus audax*, and 3 swordfish, *Xiphias gladius*, are presented.

The levels of total mercury found in white muscle of blue marlin caught in Hawaiian waters ranged from 0.19 ppm to 7.86 ppm; fish specimens ranged in total weight from 96 pounds (43.5 kg) to 906 pounds (410.9 kg). A trend of increasing mercury level with increasing size of fish was noted. The mercury content in the livers of 26 blue marlin specimens examined ranged from 0.13 ppm to 29.55 ppm; there was no apparent trend noted between mercury content in the liver and size of fish.

Striped marlin from Hawaii and southern California showed a range of mercury levels in white muscle of 0.09-1.09 ppm for the 14 Hawaii samples examined and 0.03-2.1 ppm for the 42 California samples examined. The range in size of fish was 56-139 pounds (25.4 63.0 kg) and 109-231 pounds (49.4 104.8 kg) for the

Hawaii and California samples, respectively. From the wide spread of mercury levels encountered in striped marlin, a trend of mercury level with size of fish could not be easily detected. Livers of nine specimens from the Hawaii catch were analyzed; mercury levels ranged from 0.05 ppm to 1.53 ppm.

Three swordfish weighing 6 pounds (2.7 kg), 100 pounds (45.4 kg), and an estimated 500 pounds (226.8 kg) contained mercury levels in white muscle of 0.04, 1.71, and 2.10 ppm, respectively.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Summer Concentration of White Marlin, *Tetrapturus albidus*, West of the Strait of Gibraltar. By C. Richard Robins. July 1974, p. 164-174.

ABSTRACT

Examination of fish catches landed in August 1961 at various ports in southern Portugal and the adjacent coast of Spain demonstrated that the white marlin, *Tetrapturus albidus*, concentrated in these waters during this month. The coincident absence of white marlin in landings at Sicily make it likely that the species does not enter the Mediterranean in any numbers at least at this season.

August concentrations of white marlin elsewhere in the Atlantic are discussed along with the implications of the coincident timing of them on population structure of the species.

Morphometric data are presented on 57 specimens from this eastern Atlantic population to facilitate future comparison with specimens from elsewhere in the range of the species.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—The Cape of Good Hope: A Hidden Barrier to Billfishes. By M. J. Penrith and D. L. Cram. July 1974, p. 175-187.

ABSTRACT

Since 1838 there have been isolated reports of billfishes from the southern tip of Africa, but only during the years 1961-64, when a number of Cape Town based boats fished commercially for tuna using longlines, were billfishes found to occur in considerable numbers.

The waters to the west and south of the Cape of Good Hope were found to be unique in their billfish fauna, no less than six species being represented, comprising *Xiphias*, *Makaira* (2 species), and *Tetrapturus* (3 species). Only two wide-ranging species have not been found. *Istiophorus* is commonly listed from the area on the basis of *Histiophorus granulifer*, but a reexamination of de Castelnau's type shows it to be a *Makaira*, while *T. angustirostris* could occur as it is known from off Durban.

The billfishes are probably attracted to this limited geographic area by the rich feeding grounds which are the result of the upwelling of nutrient-rich water along the Cape's west coast. It is difficult, however, to suggest reasons why there is an apparent barrier to movement between the Atlantic and Indo-Pacific Oceans for certain species. Hydrographic conditions in the area are discussed, but there are no obvious physical barriers preventing black and striped marlins from entering the Atlantic nor white marlin and longbill spearfish from moving into the Indo-Pacific.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed papers—Catch Distribution and Related Sea Surface Temperature for Striped Marlin (*Tetrapturus audax*) Caught Off San Diego, California. By James L. Squire, Jr. July 1974, p. 188-193.

ABSTRACT

Records for 4,535 marlin landed at San Diego, California, and related sea surface temperature data were examined for the period 1963 through 1970 to determine time-space distribution and the relationship of catch and sea surface temperatures. For the period 1963 through 1970 the catch of 4,535 marlin was compared to sea surface temperature conditions relative to increased catches.

Catch distribution based on 1963 to 1967 data showed that 76.4% were caught within a 35- by 40-nautical-mile area off San Diego, with the maximum catch being made from mid-August to mid-September. Catch temperatures off southern California calculated for this area from airborne infrared sea surface temperature survey data ranged from 61°F (16.1°C) to 73°F (22.8°C); the mean catch temperature was 67.8°F (19.9°C).

Sea surface temperature conditions based on 2 wk average temperature charts issued by the National Marine Fisheries Service indicate that an initial warming of water to an average temperature of 68° F (20.0°C) or above is related to an increase in catch. When average temperatures were below 68° F (20.0°C), 931 fish were caught; between 68° (20.0°C) and 70° F (21.1°C) the catch was 1,886 fish; and a further increase to 70° F (21.1°C) or above resulted in a catch of 1,718 fish.

Catch data and isotherm charts, 1963 through 1970, indicate that the continuity of the 68°F (20.0°C) and 70°F (21.1°C) isotherms from off central Baja California to off southern California is associated with improved fishing. When these isotherms were discontinuous the average catch per biweekly period was 82.0 fish; when these isotherms were continuous the average catch was 146.1 fish. The highest average catch per biweekly period (205.3 fish) was recorded when the 70° F (21.1°C) isotherm was continuous.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Results of Sailfish Tagging in the Western North Atlantic Ocean. By Frank J. Mather III, Durbin C. Tabb, John M. Mason, Jr., and H. Lawrence Clark. July 1974, p. 194-210.

ABSTRACT

Migrations of sailfish, *Istiophorus platypterus* (Shaw and Nodder), in the western North Atlantic Ocean are discussed on the basis of results of three cooperative tagging programs. The Rosenstiel School of Marine and Atmospheric Sciences (formerly Institute of Marine Science, and Marine Laboratory) of the University of Miami marked and released 1,259 sailfish between 1950 and 1958 and nine tags were returned. Members of the Port Aransas (Texas) Rod and Reel Club marked and released 515 sailfish between 1954 and 1962 and obtained three returns. The Cooperative Game Fish Tagging Program of the Woods Hole Oceanographic Institution has marked and released 12,525 sailfish between 1954 and May 1972, with 97 tags being returned.

The majority of the returns showed limited movements; most were between localities along the southeast coast of Florida and the Florida Keys. The longer migrations did not follow a distinct pattern, but many of them showed a tendency toward movements between tropical waters (northeast coast of South America, the Lesser Antilles, and the Straits of Florida) in the cold season and temperate waters (the Gulf of Mexico and the United States coast between Jacksonville, Florida and Cape Hatteras, North Carolina) in the warm season.

Times at liberty, which ranged from less than 1 day to over 4 yr, with only nine exceeding 18 mo, are generally consistent with earlier findings that the sailfish is a short lived species. Tag returns give no indication of heavy commercial fishing pressure on the stocks under study.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Migrations of White Marlin and Blue Marlin in the Western North Atlantic Ocean—Tagging Results Since May, 1970. By Frank J. Mather III, John M. Mason, Jr., and H. Lawrence Clark. July 1974, p. 211-225.

ABSTRACT

Migrations of white marlin, *Tetrapturus albidus* Poey, and blue marlin, *Makaira nigricans* Lacépède, in the western North Atlantic Ocean are discussed in terms of tag returns obtained since the completion of data collection for the paper by Mather, Jones, and Beardsley (1972) in May 1070.

In the period May 1970 May 1972, 2,039 white marlin and 216 blue marlin have been released, and 70 tags from white marlin and 1 from a blue marlin have been returned.

The migratory pattern which had been established for the stock of white marlin summering off the middle Atlantic coast of the United States has been further supported by 54 of 60 new returns from fish released in this area. The six others deviated from this pattern geographically or chronologically, or in both respects. The ten remaining returns were from releases south of lat. 33°N. Five of these fitted with previously observed patterns or individual

migrations. The other five were local or scattered, but one of them extended the range of recaptures southeastward to lat. 4°N, long. 40°W.

As previously, times at liberty have been long, and the record has been increased to 58.7 mo. A new calculation, incorporating much additional data, suggests that the annual mortality rate is between 23% and 36%.

The single blue marlin return is the first to show a significant migration—at least 750 nautical miles, from the Bahamas to the Gulf of Mexico—and the dates of release and recapture support the theory of separate populations of blue marlin in the North and South Atlantic. After 30 mo at liberty, this fish weighed twice its estimated weight at release.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Migration Patterns of Istiophoridae in the Pacific Ocean as Determined by Cooperative Tagging Programs. By James L. Squire, Jr. July 1974, p. 226-237.

ABSTRACT

Since 1954, billfish have been tagged by cooperative marine game fish tagging programs in many of the major sportfishing areas of the Pacific. Major locations of tagging have been off southern California, U.S.A., Baja California Sur and mainland Mexico, Panama, and Australia. Two cooperative marine game fish tagging programs haver operated in the Pacific, 1) the Cooperative Marine Game Fish Tagging Program, sponsored jointly by the Woods Hole Oceanographic Institution and the National Oceanic and Atmospheric Administration, National Marine Fisheries Service, and 2) a cooperative program conducted by the California Department of Fish and Game.

During 1954-1971, 15,540 billfish were tagged. Records show 9,849 striped marlin (*Tetrapturus audax*), 4,821 sailfish (*Istiophorus platypterus*), 622 black marlin (*Makaira indica*), and 248 blue marlin (*Makaira nigricans*) were tagged during this period. Ninety-seven tag recoveries have been made; these include 85 striped marlin, 10 sailfish, and 2 black marlin. Eighty-one percent of these recoveries were by longline fishing vessels, the remainder by marine sport fishermen.

The tag recovery rates were 0.88% for striped marlin, 0.32% for black marlin, and 0.24% for sailfish.

Four types of tags were used in the two programs. Two types of metal tip dart tags were used by the Woods Hole Oceanographic Institution; metal tipped single- and double-barbed plastic dart tags were used by the National Marine Fisheries Service; and a single-barb plastic dart tag was used by the California Department of Fish and Game. Tag types giving the best recovery rate for striped marlin and sailfish were the plastic single- and double-barbed dart tags.

Recovery data for striped marlin tagged in the eastern Pacific show a movement away from the tip of Baja California in a south to southwest direction in late spring and early summer. Some recoveries were made of fish tagged near the tip of Baja California and recaptured northwest of the tip of Baja California, Mexico. The migration pattern to the south and southwest at this time of the year may be related to spawning. Striped marlin tagged off southern California show a migration to the south in late summer and early fall. Recoveries of striped marlin in the eastern Pacific were generally short-term (average of 89 days) and covered short distances, averaging 281 nautical miles. Only three of 85 tagged striped marlin, and one of two tagged black marlin, were recovered 1,000 nautical miles or more from the site of tagging. The few recoveries of tagged black marlin (2) and sailfish (10) did not provide sufficient data to determine migration patterns for these species.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed papers—Occurrence of Young Billfishes in the Central Pacific Ocean. By Walter M. Matsumoto and Thomas K. Kazama. July 1974, p. 238-251.

ABSTRACT

Plankton and other net-caught samples collected on past cruises of the National Marine Fisheries Service, Honolulu Laboratory vessels in Hawaiian and central Pacific equatorial waters were examined for billfish larvae and juveniles. Of the 342 billfish young found in 4,279 net tows, 209 were blue marlin, *Makaira nigricans*, 82 were shortbill spearfish, *Tetrapturus angustirostris*, 2 were sailfish, *Istiophorus platypterus*, 20 were swordfish, *Xiphias gladius*. Twenty-nine larvae were unidentified owing to excessive damage. A preponderance of the catches was obtained from hauls made at the surface during daylight.

In the equatorial central and North Pacific larvae of only three of the six billfish species nominally found in the Pacific were taken. The captures of these larvae (blue marlin, shortbill spearfish, and swordfish) fill the gaps in the known distribution of istiophorids and swordfish, and extend their distribution eastward to the Hawaiian Islands in the North Pacific. The two sailfish larvae were taken in New Hebrides waters in the western South Pacific.

The absence of striped marlin, *Tetrapturus audax*, larvae in Hawaiian waters was significant, since this species comprises nearly 82% of all istiophorids taken on the longline in the Hawaiian fishery. Their absence suggested that the striped marlin in Hawaiian waters probably migrate elsewhere to spawn. If this true, then the spawning habits of this species differ significantly from those of blue marlin. A similar situation could hold for sailfish also.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Distribution of Larval Swordfish in the Northwest Atlantic Ocean. By Gretchen E. Markle. July 1974, p. 252-260.

ABSTRACT

Surface plankton collections, mostly with neuston nets towed at 4-5 knots, during eight cruises (1965-1972) yielded 119 swordfish larvae 6-110 mm total length. Captures were grouped in discrete geographical areas: Virgin Islands, Guiana current, Northwest Caribbean, Windward Passage, and Florida current. All collections were made in January-April, but comparison with other published data suggests that this may not be the peak spawning period. Descriptions of swordfish larvae are appended.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—The Distribution of the Larvae of Swordfish, *Xiphias gladius*, in the Indian and Pacific Oceans. By Yasuo Nishikawa and Shoji Ueyanagi. July 1974, p. 261-264.

ABSTRACT

The distribution of larval swordfish, *Xiphias gladius*, was determined on the basis of 325 specimens collected from Japanese research vessels operating in the Indian and Pacific Oceans. These larvae, ranging from 3 to 160 mm in total length, were caught by larva-net tows and by dip netting.

The larvae are distributed over virtually the entire tropical and subtropical areas of the Pacific Ocean except for the eastern Pacific east of long. 100°W. The northernmost occurrence was at lat. 31°N, long. 132°E, near Kyushu in the western Pacific, and the southernmost was at lat. 22°38'S, long. 105°24'W in the eastern Pacific. Data were insufficient to delineate the distribution in the Indian Ocean.

The surface water temperature in the areas of larval swordfish occurrence ranged from 24.1° to 30.7°C.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Notes on the Tracking of the Pacific Blue Marlin, *Makaira nigricans*. By Heeny S. H. Yuen, Andrew E. Dizon, and James H. Uchiyama. July 1974, p. 265-268.

ABSTRACT

In July of 1971 and 1972 five Pacific blue marlin, *Makaira nigricans*, were tagged with temperature sensing, ultrasonic transmitters off the west coast of Hawaii. These were tracked for durations up to 22½ h. The paths of three showed movement in a northerly direction. The other two showed no movement. Average swimming speed ranged from 2.2 km/h to 3.4 km/h for the three fish tracked. Swimming depths differed considerably among the three.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review

and Contributed Papers—An Analysis of the Sportfishery for Billfishes in the Northeastern Gulf of Mexico During 1971. By Eugene L. Nakamura and Luis R. Rivas. July 1974, p. 269-289.

ABSTRACT

Data were obtained on the sportfishery for billfishes off South Pass, Louisiana, and off northwest Florida in 1971. These data included: dates and times of raises, hookups, and catches by species; locations of raises; areas fished; baits used; water color; surface conditions; boat characteristics. A total of 99 blue marlin (*Makaira nigricans*), 284 white marlin (*Tetrapturus albidus*), and 318 sailfish (*Istiophorus platyterus*) were caught and recorded during 11,107 hours of fishing in the northeastern Gulf of Mexico. White marlin was most abundant in July and August, while sailfish was most abundant in the latter half of September off northwest Florida. Similar periods of abundance for these two species were not evident off South Pass. Blue marlin did not have an especially abundant period in their area. White marlin and sailfish were more abundant off northwest Florida than off South Pass, whereas the reverse was true for blue marlin. The hours of greatest relative abundance for all species of billfishes combined were between 1000 and 1200 and again between 1300 and 1500 off South Pass. A similar pattern was found off northwest Florida (1000-1100 and 1400-1500). Results indicated that the bluer the water, the greater the relative abundance of each of the three species. Off South Pass more billfishes were raised along lines and rips than in any other surface condition, whereas off northwest Florida, more billfishes were raised in open water than in any other surface condition. Moon phase appeared not to have any significant effect on billfishing. Neither did the length of the fishing boats. However, of the boats in the 40 to 49 ft length category, those with twin screws raised more billfishes than those with single screw. Off northwest Florida, blue marlin preferred mullet (*Mugil cephalus*) over ballyhoo (*Hermiramphus* sp.) and bonito (*Euthynnus alleteratus*) strip as bait; white marlin showed no preference; while sailfish preferred bonito strip. Off South Pass, data on bait preference were insufficient to allow conclusions.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Angler Catch Rates of Billfishes in the Pacific Ocean. By James L. Squire, Jr. July 1974, p. 290-295.

ABSTRACT

In 1969, 1970, and 1971 marine game fish anglers participating in the Pacific phase of the National Marine Fisheries Service cooperative marine game fish tagging program were asked to complete a postcard form which requested information of the number of days of billfishing the angler engaged in and the catches made. From the 17,876 angler days reported, the catch consisted of 10,234 billfishes. The average for the 3-yr period was 0.57 billfish per angler-day or 1.75 days of fishing per billfish. Analysis of data for the geographical areas in the eastern Pacific and Australia (Queensland) where billfishing is conducted resulted in a wide range of catch per effort for all billfish species combined. Off southern California, U.S.A., the catch was 0.10 fish per angler-day, equaling 10.3 days of fishing per fish. Off Baja California, Mexico, records show 0.82 fish per angler-day equaling 1.22 days fishing per fish, and fishing off Mazatlán yielded 1.21 fish per angler-day and 0.82 days fishing per fish. Off Acapulco, Mexico, the results were 0.95 fish per angler-day and 1.05 days per fish. Fishing off Australia the records show 0.55 fish per angler-day equaling 1.83 days per fish.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—The Canadian Swordfish Fishery. By S. N. Tibbo and A. Sreedharan. July 1974, p. 296. Abstract only.

ABSTRACT

During the early 1960's the traditional harpoon fishery for swordfish off the east coast of Canada was replaced by a longline fishery. Fishing areas and seasons expanded, landings increased, and size composition of the catch decreased. Catch and effort data for the period 1958 to 1970 covering both fishing methods were analyzed and the results are presented.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Landings of Billfishes in the Hawaiian Longline Fishery. By Howard O. Yoshida. July 1974, p. 297-301.

ABSTRACT

The landings of the Hawaiian longline fishery are dominated by the tunas. During 1964 to 1967, the tunas, by weight, made up an average of 66% of the catch, whereas the marlins and swordfish, *Xiphias gladius*, comprised about 34%. The catch of billfishes is composed of the striped marlin, *Tetrapturus audax*, blue marlin, *Makaira nigricans*, black marlin, *M. indica*, sailfish, *Istiophorus platypterus*, shortbill spearfish, *T. angustirostris*, and swordfish.

The annual landings of blue marlin ranged between 47 and 366 metric tons during 1952 to 1970. The annual landings of striped marlin fluctuated between 93 and 228 metric tons during the same period. The blue marlin dominated the catch from 1952 to 1961. Subsequent to 1963, the billfish catches have been dominated by the striped marlin.

The monthly landings and the monthly catch rates of blue marlin and striped marlin showed similar trends. The monthly landings of striped marlin, however, showed greater fluctuations than the monthly catch per unit of effort. This was attributed in part to a change in the size composition of striped marlin in the third quarter.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Fishery-Oceanographic Studies of Striped Marlin, *Tetrapturus audax*, in Waters Off Baja California. I. Fishing Conditions in Relation to the Thermocline. By Eiji Hanamoto. July 1974, p. 302-308.

ABSTRACT

In this report, the author analyzed fishing conditions for striped marlin in waters off Baja California in relation to the thermocline. The results were as follows:

1. In subarea SW, bounded by lat. 15°-25°N and long. 115°-110°W, catch rates begin increasing from about May and reach a peak between July and October. In subarea SE, bounded by lat. 15°-25°N and long. 110°-105°W, there appears to be a tendency for catch rates to be highest from July through October. In subarea M, bounded by lat. 10°N to along the coast of Mexico and long. 105°-95°W, catch rates are highest between May and July.

2. From December through March there is good fishing in relatively narrow areas around the tip of Baja California. In April, a good fishing ground appears off Manzanillo and in May this ground begins to expand seaward. From June, the area of good fishing off the coast from Acapulco to Mazatlán begins to expand seaward and the greatest expansion of grounds occurs off Baja California in September. In October, the ground becomes narrow and is located farther east.

3. The pattern of expansion and contraction of the shallow thermocline area coincides fairly closely with the pattern of expansion and contraction of good fishing grounds. One of the factors related to this phenomenon is that the formation of good fishing grounds off Baja California is considered to be related to the shallow thermocline areas where there is a more abundant food supply.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—A Review of the Longline Fishery for Billfishes in the Eastern Pacific Ocean. By James Joseph, Witold L. Klawe, and Craig J. Orange. July 1974, p. 309-331.

ABSTRACT

Catch and effort statistics from the Japanese longline fishery are used to examine the quarterly distribution of each of the six species of billfishes taken in the eastern Pacific Ocean east of long. 130°W. Striped marlin appear to be the most widely distributed billfish in the eastern Pacific. Blue marlin are confined more to the equatorial high seas regions than the other species. Sailfish are extremely abundant within 600 miles of the shoreline along Mexico and Central America. Shortbill spearfish are relatively sparsely distributed and less abundant in inshore waters than are sailfish. Black marlin are

the least widely distributed and least abundant of the billfishes in the eastern Pacific. Swordfish are abundant in waters around Baja California, Mexico, and near northern Peru and southern Ecuador. They are also frequently encountered in or near the cool upwelled water along the equator.

Trends in abundance, as reflected by catch/1,000 hooks and total catch, are discussed. On the southern grounds of the striped marlin fishery, apparent abundance of this species has dropped to about a third of its highest level, but fishing success has remained constant on the northern grounds. Catches of striped marlin reached their peak in 1968 (337,000 fish); by 1970 the catch had dropped to 180,000 fish. Apparent abundance and catches of blue marlin also decreased from levels in the early 1960's. In 1963, 75,000 blue marlin were taken but the catch decreased to about 22,000 fish by 1966 and has fluctuated about that level since. Because so few black marlin are taken in the eastern Pacific, trends in the abundance of this species are not discussed. The longline fishery for sailfish in the eastern Pacific began in a substantial way in 1965 with a catch rate of about 80 fish/1,000 hooks on the major sailfish grounds but by 1970 this had dropped to about 11 fish/1,000 hooks. Also catches on these grounds dropped from a peak of about 370,000 fish in 1965 to about 210,000 fish in 1970. Catches of swordfish continued to increase from the beginning of the fishery in the 1950's until 1969, the peak year, when about 112,000 fish were landed. Catches decreased in 1970, although effort decreased also. The apparent abundance of swordfish has shown no general decreasing trends.

A general discussion of the needs of scientific research on billfishes is given in the final section of the report.

(675.) Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and Contributed Papers—Billfish Fishery of Taiwan. By H. C. Huang. July 1974, p. 332-335.

ABSTRACT

Billfish landings made by Taiwan fishing vessels from 1962 to 1971 were analyzed and described briefly. Billfishes are commercially harvested in Taiwan by deep-sea and inshore longline fisheries and the harpoon fishery. The important species caught include swordfish, striped marlin, blue marlin, black marlin, and sailfish. The deep-sea longline fishery has developed rapidly since 1954 and the landings of billfishes have increased accordingly. Fishing operations have covered the major fishing grounds of the Pacific, Indian, and Atlantic Oceans. The inshore longline fishery still confines its activities to waters around Taiwan; billfish landings made by this fishery fluctuate annually.

676. Price Spreads and Cost Analyses for Finfish and Shellfish Products at Different Marketing Levels. By Erwin S. Penn. March 1974, vi + 74 p., 15 figs., 12 tables, 12 app. figs., 41 app. tables.

ABSTRACT

The rapid increase of fish prices has recently caused public concern. To find the cause of the difference between the price the fisherman receives for his product and the ultimate price paid by the consumer, the report analyzes the distribution of the consumer's dollar paid to the retailer as well as to the wholesaler, processor, and fisherman.

Selected for this study are seven finfish, two canned fish, and four shellfish products. The difference or margin between selling and purchasing prices of each level and the share of the consumer's dollar by each level and each cost component are calculated for each fish product. The report also analyzes the costs and profits incurred by each marketing function and describes the major influence on margin differences.

The objective of the study is to give individual firms in the fishery a systematic guide to examine their margins, costs, and profits for each fish product; compare them with the data presented in this study, as national averages for the same product; and determine whether there is room for improvement for their performance and services.

677. Abundance of Benthic Macroinvertebrates in Natural and Altered Estuarine Areas. By Gil Gilmore and Lee Trent. April 1974, iii + 13 p., 11 figs., 3 tables, 2 app. tables.

ABSTRACT

The abundance of benthic macroinvertebrates during March-October 1969 in West Bay, Texas, was compared between 1) a natural marsh area, 2) an adjacent marsh area altered by channelization, bulkheading, and filling, and 3) an open bay area. Animals representing four phyla were caught. Abundance indices (areas combined) of the four groups in terms of numbers were 66.4% polychaetes, 29.6% crustaceans, 2.5% pelecypods, and 1.5% nemerteans; volumes were 44.0% polychaetes, 40.8% pelecypods, 10.7% nemerteans, and 4.4% crustaceans.

When all organisms were combined, they were slightly more abundant numerically and over twice as abundant volumetrically in the marsh than in the canals and were least abundant in the bay. Polychaetes were most abundant in the canals and least abundant in the bay; abundance was highest at stations with low to intermediate amounts of silt and clay or where vegetative matter was composed mostly of live sea grasses or detritus. Crustaceans were more abundant in the natural marsh than in the other two areas and showed a definite preference for sandy substrate in marsh areas. Pelecypods were numerically most abundant in the bay but volumetrically the marsh had the highest standing crop. Nemerteans were most abundant in the marsh and least abundant in the bay.

In general, the seasonal abundance of polychaetes and nemerteans varied little during the study, whereas crustaceans and pelecypods were abundant only during the spring and early summer. An exception to this seasonal abundance pattern was the reduction in numbers of polychaetes at the uppermost canal station where the habitat was apparently unsuitable due to low oxygen levels during the summer and early fall.

678. Distribution, Abundance, and Growth of Juvenile Sockeye Salmon, *Oncorhynchus nerka*, and Associated Species in the Naknek River System, 1961-64. By Robert J. Ellis. September 1974, v + 53 p., 27 figs., 26 tables.

ABSTRACT

The Naknek River system contains eight interconnected and generally biologically discrete basins, each with a different ratio of spawning grounds to rearing area for sockeye salmon, *Oncorhynchus nerka*, and different densities of juvenile sockeye salmon and associated species of fish. Juvenile sockeye salmon and other pelagic species were sampled with tow nets at night. Sockeye salmon were the most common and abundant species in all basins, followed by threespine sticklebacks, ninespine sticklebacks, and pond smelt. Eighteen other species of potential competitor or predator fish were present.

In the summers of 1961 to 1963, juvenile sockeye salmon in the pelagic areas had a characteristic pattern of abundance for the entire system: abundance (catch per tow)of age 0 increased from early summer to midsummer and then declined to late August. The abundance in late August varied about threefold and, in general, was independent of variations in the number of parents from 1960 to 1963.

In July the abundance of age 0 fish in each basin was proportional to the amount of known contiguous spawning ground, but by late August this relation no longer existed. This change was at least partly due to migration of the age 0 fish—generally from basins of greater abundance of fish to those of lesser abundance. The larger and faster growing fish were the first to migrate. Not all basins were involved in these migrations.

The production of sockeye salmon smolts in the Naknek system is relatively stable. At least three major factors probably contribute to this stability: (1) the presence of several major spawning units or races in widely separated spawning grounds of different types, (2) the presence of several connected lakes, and (3) the migratory behavior of juvenile sockeye salmon during their first summer.

A mechanism which prevents the population of juvenile sockeye salmon from exceeding some upper limit is not apparent in the Naknek system. A reduction in growth in areas of high density was not apparent in the Naknek system in 1961-64 and apparently did not occur in 1957-65. Many kinds of predators on juvenile salmon are present but probably are not limiting production of smolts.

The data on abundance and growth of juvenile sockeye salmon and the distribution of the escapement and spawning grounds indicate that it should be possible to increase the production of sockeye salmon in the Naknek system. Two of the major basins, North Arm and Brooks Lake, which constitute about 35% of the system, are now producing juveniles at very low levels. North Arm appears to suffer from too little spawning area, whereas Brooks Lake appears to have adequate spawning area but too few spawners.

Three factors in the biology of juvenile sockeye salmon of the Naknek system are of special significance to the managers of the resource and should be investigated in any effort to enhance the production of sockeye salmon in the Naknek system: (1) the abundance of smolts each spring is fairly constant for the system as a whole and not closely related to the abundance of the parents or, from 1961-64, even to the original abundance of age 0 fish; (2) the apparent growth of juvenile sockeye salmon and potential competitor species is not related to the abundance of these fish in any lake of the Naknek system; and (3) two major lakes, constituting about 35% of the rearing waters, do not receive age 0 sockeye salmon from other basins and are supporting relatively few sockeye salmon.

The question of what escapement of adult sockeye salmon is needed to ensure full production of juveniles is considered. The present study indicates that escapements in the range of 600,000 to 1,000,000 fish, as recommended by other studies, would probably fully use the present combination of spawning and rearing areas without danger of overburdening the food supply.

679. Kinds and Abundance of Zooplankton Collected by the USCG Icebreaker *Glacier* in the Eastern Chukchi Sea, September-October 1970. By Bruce L. Wing. August 1974, iv + 18 p., 14 figs., 6 tables.

ABSTRACT

Zooplankton samples were taken at 39 oceanographic stations in the eastern Chukchi Sea in September and October 1970. Sampling was done by vertical tows from near bottom to the surface with a 0.5 m diameter No. 0 (0.57 mm) mesh NorPac standard plankton net. Data are presented on the distribution and relative abundance of 63 categories of zooplankton at the onset of winter. Zooplankton abundance generally was lowest in waters with temperatures below 0°C; it did not appear to be associated with the distribution of salinity; and it tended to be inversely related to dissolved oxygen concentration. Comparison of zooplankton abundance in 1970 with published observations on the Chukchi Sea in 1947 shows probable seasonal variation of meroplankton abundance and yearly variation of holoplankton abundance.

680. Pelagic Amphipod Crustaceans from the Southeastern Bering Sea, June 1971. By Gerald A. Sanger. July 1974, iii + 8 p., 3 figs., 3 tables.

ABSTRACT

Fourteen species of pelagic amphipods were present in zooplankton samples collected from the southeastern Bering Sea in June 1971. *Parathemisto pacifica* strongly dominated relative abundance (68-96%) and was present in numbers up to an estimated 2,755/1,000 m^3 of water. *Primno macropa*, was the only other species present in all hauls and ranged from 4 to 27% in relative abundance. *Cyphocaris challengeri* was present in numbers up to 48/1,000 m^3 during night hauls, but only one animal was taken in all daylight hauls. *Hyperia medusarum* was present in 14 (82%) of the hauls but accounted for less than 1% of the total numbers.

A presumed diurnal vertical migration was evidenced for *Primno macropa*, *Cyphocaris challengeri*, and possibly for *Scina rattrayi*, *Hyperoche medusarum*, and *Hyperia medusarum*.

The occurrence of *Scina stebbingi*, *S. rattrayi*, *Vibilia caeca* (?), *Paraphronima crassipes*, *Phronima sedentaria*, and *Primno macropa* extended their known ranges in the Bering Sea eastward, and the occurrence of *Cyphocaris anonyx* represents a new record for the Bering Sea.

681. Physiological Response of the Cunner, *Tautogolabrus adspersus*, to Cadmium. October 1974, iv + 33 p.

SUMMARY ABSTRACT

The cunner, *Tautogolabrus adspersus*, was exposed to six concentrations of cadmium, as cadmium chloride ($CdCl_2 \cdot 2\frac{1}{2}H_2O$), for 96 h. At the end of this exposure period, tests of blood serum osmolality and gill tissue oxygen consumption were performed. High levels (48 ppm) of this metal resulted in abnormally high serum osmolality, and an exposure as low as 3 ppm reduced the normal rate of oxygen consumption. Both of these parameters may be related to observed tissue damage.

The histopathological effects of acute exposure of the cunner to cadmium were manifested in the kidney, intestine, hemopoietic tissue, epidermis, and gill. Few significant changes were noted in fish exposed to concentrations less than 48 ppm. The results implicate renal failure as the probable cause of death subsequent to acute exposure to cadmium.

Clearance of intracardially injected bacteria from the blood of cunners exposed to 12 ppm cadmium was examined. The rate of bacterial uptake in the cells of the liver and spleen was increased, but the bacterial death rate within these cells was decreased. Exposure of fish at 3 to 24 ppm failed to influence antibody production against sheep red blood cells.

The activity of two liver enzymes changed significantly with exposure to cadmium. Aspartate aminotransferase was lower in the exposed fish, and a magnesium linked oxidoreductase in exposed fish required 10 times as much added magnesium to reach the same level of activity as in the control fish.

Chemical analyses were made for uptake and clearance of cadmium from exposed cunners. In the uptake study, cadmium residues averaged 8.5 times higher in liver than in gills. In the clearance study, substantial reductions in cadmium residues were found in the gills and blood of fish held in clean seawater for 6 wk after exposure to cadmium, as compared to fish sacrificed immediately after exposure. Muscle and carcass samples from the "cleared" fish showed little reductions in cadmium levels.

(681.) Physiological Response of the Cunner, *Tautogolabrus adspersus*, to Cadmium. I. Introduction and Experimental Design. By Anthony Calabrese, Ries S. Collier, and James E. Miller. October 1974, p. 1-3.

(No abstract)

(681.) Physiological Response of the Cunner, *Tautogolabrus adspersus*, to Cadmium. II. Uptake of Cadmium by Organs and Tissues. By Richard A. Greig, Albert E. Adams, and Betty A. Nelson. October 1974, p. 5-9, 2 figs., 2 tables.

ABSTRACT

Cadmium uptake and clearance data were obtained on cunners, *Tautogolabrus adspersus*, exposed to various concentrations of this metal in artificial seawater.

In the uptake study, cunners were exposed to 0, 3, 6, 12, 24, and 48 ppm cadmium in seawater for 4 days. Cadmium residues averaged 8.2 times higher in livers than in gills. At the 48 ppm cadmium exposure level, the livers averaged 195 ppm, as compared to 33.5 ppm for gills (wet weight values).

In the clearance study, cunners were exposed to 24 ppm cadmium in seawater for 4 days, after which time half of the fish were placed in clean flowing seawater for 1 mo and half were sacrificed immediately to determine initial cadmium residue concentrations. Gill, liver, blood, muscle, and carcass samples were analyzed. Substantial reductions in cadmium residues were found in the gills and blood of fish held in clean seawater, as compared to samples from fish sacrificed immediately after exposure to cadmium. Liver samples produced variable results: livers of fish held in clean seawater for 1 mo contained 62-155 ppm cadmium for four fish and 5-11 ppm for three fish, as compared to 30-117 ppm for livers from eight fish sacrificed immediately after exposure to cadmium. Muscle and carcass samples from the "cleared" fish showed very little reduction in cadmium levels.

(681.) Physiological Response of the Cunner, *Tautogolabrus adspersus*, to Cadmium. III. Changes in Osmoregulation and Oxygen Consumption. By Frederick P. Thurberg and Margaret A. Dawson. October 1974, p. 11-13, 1 fig.

ABSTRACT

The cunner, *Tautogolabrus adspersus*, was exposed to various concentrations of cadmium, as cadmium chloride ($CdCl_2 \cdot 2\frac{1}{2}H_2O$), for 96 h. At the end of this exposure period tests of blood serum osmolality and gill tissue oxygen consumption were performed. High levels (48 ppm) of this metal resulted in an abnormally high serum osmolality and an exposure as low as 3 ppm reduced the normal rate of oxygen consumption. Both of these parameters may be related to observed tissue damage.

(681.) Physiological Response of the Cunner, *Tautogolabrus*

adspersus, to Cadmium. IV. Effects on the Immune System. By Richard A. Robohm and Maureen F. Nitkowski. October 1974, p. 15-20, 1 fig., 1 table.

ABSTRACT

Two elements of the immune system in cunners, *Tautogolabrus adspersus*, were examined after 96-h exposure to cadmium: 1) clearance of intracardially injected bacteria from the bloodstream and 2) ability to produce antibody against intraperitoneally injected sheep red blood cells (SRBC). Exposure to 12 ppm cadmium increased the rates of bacterial uptake in phagocytes of the liver and spleen but significantly decreased the rates of bacterial killing within these cells. Exposure of fish at 3 to 24 ppm cadmium failed to influence antibody production against SRBC. These results indicate that cadmium affects one aspect of cellular immunity but not humoral immunity in cunners. This effect may increase susceptibility to infection.

(681.) Physiological Response of the Cunner, *Tautogolabrus adspersus*, to Cadmium. V. Observations on the Biochemistry. By Edith Gould and John J. Karolus. October 1974, p. 21-25, 1 fig., 3 tables.

ABSTRACT

In the liver of cunner, *Tautogolabrus adspersus*, exposed to 3 ppm and to 24 ppm Cd for 96 h, aspartate aminotransferase activity was 71% and 59%, respectively, of the activity in livers of control fish.

In the livers of cunners exposed to 24 ppm Cd, nictinamide-adenine dinucleotide reductase activity required 20 m*M* Mg for activation of the same order that 2 m*M* Mg produced in control livers.

Although individual variation precludes generalization here, what may be a metal-complexing group of proteins in the serum of cadmium-exposed cunner warrants further electrophoretic study.

(681.) Physiological Response of the Cunner, *Tautogolabrus adspersus*, to Cadmium. VI. Histopathology. By Martin W. Newman and Sharon A. MacLean. October 1974, p. 27-33. 8 figs., 1 table.

ABSTRACT

The histopathological effects of acute exposure of cunner, *Tautogolabrus adspersus*, to water containing cadmium chloride were manifested in the kidney, intestine, hemopoietic tissue, epidermis, and gill. Few significant changes were noted in fish exposed to concentrations less than 48 ppm for 96 h. The results implicate renal failure as the probable cause of death after acute exposure to cadmium.

682. Heat Exchange Between Ocean and Atmosphere in the Eastern North Pacific for 1961-71. By N. E. Clark, L. Eber, R. M. Laurs, J. A. Renner, and J. F. T. Saur. December 1974, iii + 108 p., 2 figs., 1 table, 5 plates.

ABSTRACT

Summaries of large-scale heat exchange between ocean and atmosphere in the eastern North Pacific Ocean are presented for the period 1961 through 1971. The summaries are based on computations made from synoptic marine radio weather reports and include 1) monthly values of total heat exchange and departures from a long-term mean; 2) long-term monthly mean values of the total heat exchange, incoming solar radiation, effective back radiation, and evaporative and sensible heat transfer; and 3) annual cycles of total heat exchange for selected areas.

Outstanding spatial and temporal features of the heat exchange values are discussed. However, little detail is given since this is a summary report, and the readers can draw their own conclusions depending upon the intended use of the charts.

Comparisons are also made between the total heat exchange values and those given in two other reports. Discrepancies between values given in this report and those published in the other reports are attributed to differences in empirical equations used to make the heat exchange computations, differences in data processing techniques, differences in the observed data used in the computations due to different methods of acquisition, and the possibility of ocean climate changes.

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ABFL-3. Salmon Fry Production in a Gravel Incubator Hatchery, Auke Creek, Alaska, 1971-72. By Jack E. Bailey and Sidney G. Taylor. November 1974, iv + 13 p., 12 figs., 6 tables.

ABSTRACT

Survival and physical characteristics of pink salmon fry, *Oncorhynchus gorbuscha*, incubated in two types of boxes, each box containing about $1 m^3$ of gravel, and a Health incubator were compared with fry from natural spawning to evaluate the use of boxes to produce fry. The gravel incubators were seeded at densities of 74,200 to 198,000 eyed eggs/m^3. Survival from eyed eggs to emergent fry ranged from 79 to 97% in artificial incubation, but the number of incubators tested was too small to define any relationships between survival and incubator type or egg density. With artificial incubation in gravel, survival from potential eggs in females to emergent fry was 69%, whereas with natural spawning and incubation in the creek, survival was about 12%.

Fry emerged from gravel incubators about 3 days earlier than from the streambed. The gravel incubator fry were larger than tray fry but smaller than creek fry. The smaller size of the gravel incubator fry could not be explained entirely on the basis of early emergence.

Further studies were recommended to determine whether the muskeg sediment that accumulated in the incubators, the low oxygen level (57 to 69% saturation), or the substrate particle size and composition inhibited growth of the embryos.

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370. Collecting and processing data on fish eggs and larvae in the California Current region. By David Kramer, Mary J. Kalin, Elizabeth G. Stevens, James R. Thrailkill, and James R. Zweifel. November 1972, iv + 38 p., 38 figs., 2 tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

371. Ocean fishery management: Discussions and research. By Adam A. Sokoloski (editor). (17 papers, 24 authors.) April 1973, vi + 173 p., 38 figs., 32 tables, 7 appendix tables.

372. Fishery publications, calendar year 1971: Lists and indexes. By Thomas A. Manar. October 1972, iv + 24 p., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

374. Marine flora and fauna of the northeastern United States. Annelida: Oligochaeta. By David G. Cook and Ralph O. Brinkhurst. May 1973, iii + 23 p., 82 figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

375. New Polychaeta from Beaufort, with a key to all species recorded from North Carolina. By John H. Day. July 1973, xiii + 140 p., 18 figs., 1 table. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

376. Bottom-water temperatures on the continental shelf, Nova Scotia to New Jersey. By John B. Colton, Jr. and Ruth R. Stoddard. June 1973, iii + 55 p., 15 figs., 12 appendix tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

377. Fishery publications, calendar year 1970: Lists and indexes. By Mary Ellen Engett and Lee C. Thorson. December 1972, iv + 34 p., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

378. Marine flora and fauna of the northeastern United States. Protozoa: Ciliophora. By Arthur C. Borror. September 1973, iii + 62 p., 5 figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

379. Fishery publications, calendar year 1969: Lists and indexes. By Lee C. Thorson and Mary Ellen Engett. April 1973, iv + 31 p., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

380. Fishery publications, calendar year 1968: Lists and indexes. By Mary Ellen Engett and Lee C. Thorson. May 1973, iv + 24 p., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

381. Fishery publications, calendar year 1967: Lists and indexes. By Lee C. Thorson and Mary Ellen Engett. July 1973, iv + 22 p., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

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383. Fishery publications, calendar year 1965: Lists and indexes. By Lee C. Thorson and Mary Ellen Engett. July 1973, iv + 12 p., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

384. Marine flora and fauna of the northeastern United States. Higher plants of the marine fringe. By Edwin T. Moul. September 1973, iii + 60 p., 109 figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

385. Fishery publications, calendar year 1972: Lists and indexes. By Lee C. Thorson and Mary Ellen Engett. November 1973, iv + 23 p., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

386. Marine flora and fauna of the northeastern United States. Pycnogonida. By Lawrence R. McCloskey. September 1973, iii + 12 p., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

387. Marine flora and fauna of the northeastern United States. Crustacea: Stomatopoda. By Raymond B. Manning. February 1974, iii + 6 p., 10 figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

388. Proceedings of the first U.S.-Japan meeting on aquaculture at Tokyo, Japan, October 18-19, 1971. William N. Shaw (editor). (18 papers, 14 authors.) February 1974, iii + 133 p. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

389. Marine flora and fauna of the northeastern United States. Crustacea: Decapoda. By Austin B. Williams. April 1974, iii + 50 p., 111 figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

390. Fishery publications, calendar year 1973: Lists and indexes. By Mary Ellen Engett and Lee C. Thorson. September 1974, iv + 14 p., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

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